A LABORATORY AERATION SYSTEM FOR REARING AQUATIC INVERTEBRATES[1]

Lynda D. Corkum, Elizabeth C. Hanes[2]

ABSTRACT: A dependable aeration system that can simultaneously provide a consistent, continuous air supply to several hundred small (500 mL) containers is described for rearing aquatic invertebrates. A laboratory air line or aquarium pump provides sufficient pressure to force air through main lines of clear plastic tubing that branch into shorter stoppered lengths. Air is fed into individual tanks by plastic capillary tubing, both ends of which are fitted with hypodermic needles. One needle is inserted into the main air line; the second needle is attached to the inner tank wall to project beneath the water surface.

A reliable aeration system is often essential when rearing aquatic invertebrates or when using a large number of aquatic chambers in laboratory experiments. A consistent, continuous air supply can be difficult to maintain. Here, we describe a simple, dependable system suitable for simultaneously providing air to many small (500 mL) units.

The aeration system consists of a main line of clear plastic tubing (inner diameter (I.D.), 4.8 mm; outer diameter (O.D.), 8 mm) that leads from an air outlet source through a filter tube (Balston DFU Grade BK) to a five-gang valve splitter. The filter removes particulate matter that may pass through the air line. Lines of tubing extend from each valve of the splitter. Branch lines, 0.5 m long, can be added with three-way valves or T-connectors. All tubes are stoppered at their distal end (neoprene plugs that cap insect genitalia vials work well and fit snugly into the tubing). Commercial aquarium clamps also may be used to stopper tubes. Short sections of blind tubes connected by cross tubes are preferable to one long tube to insure a continuous even supply of air throughout the network (Fig. 1).

Smaller (capillary) tubes (I.D., 0.8 mm; O.D., 2.4 mm) are connected to the network of lines using hypodermic needles. We use Yale 21G 1.5 (38.1 mm) bevelled, disposable hypodermic needles (Becton-Dickinson & Co.). Alternatively, surgical tubing and needles, available in a variety of sizes, may be substituted. The needles are prepackaged with plastic syringe connectors. To expose the open, cross-sectional end of the metal needle for air passage, we use two pairs of pliers to remove the plastic connector from each needle. It is advisable to wear safety glasses during this procedure.

The blunt end of a needle can be pushed into the capillary tubing. We

[1]Received March 20, 1989. Accepted April 29, 1989.

[2]Department of Biological Sciences, University of Windsor, Windsor, Ontario N9B 3P4, Canada.

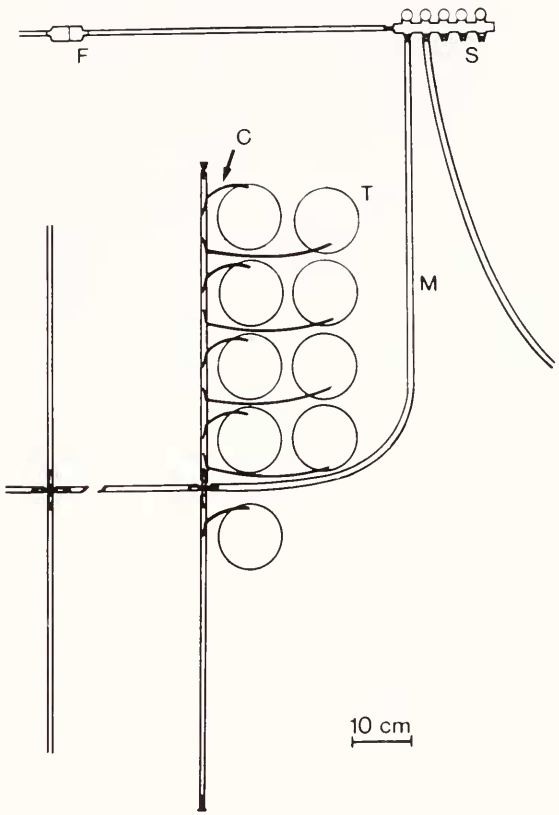

Fig. 1. Schematic of aeration system. A main air line leads through a filter (F) to a five-valve gang splitter (S). Capillary tubing (C) from main air line (M) is attached to each rearing tank (T).

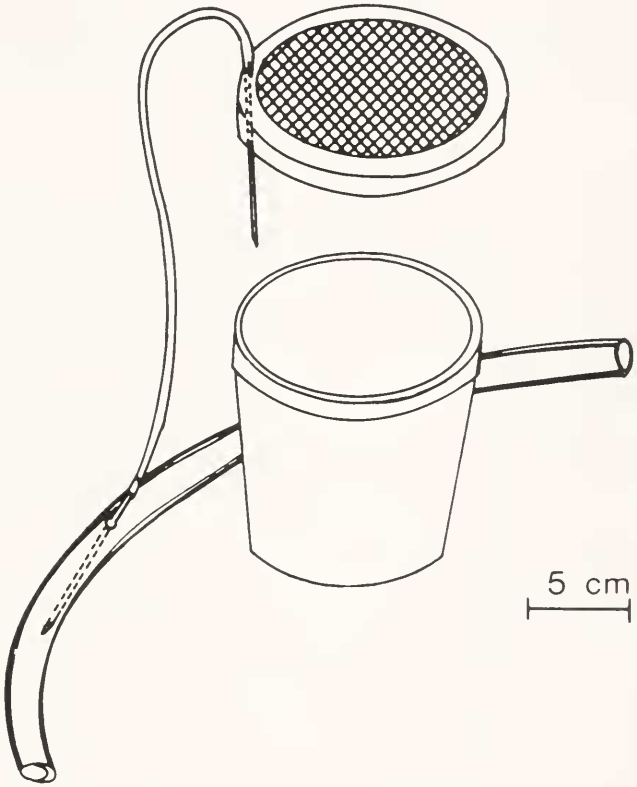

Fig. 2. Rearing tank, emergence lid, aeration tubing and syringes. Hatched area of lid represents nylon hardware cloth.

fit lengths (15 to 25 cm) of capillary tubes with needles at each end. We use one needle to puncture the outer wall of the main tubing and push the point in so that the needle rests in the air space of the tubing; the capillary tube trails away from the main line. Typically, we have inserted up to 15 capillary leads along one 0.5 m tube length.

The distal needle of each capillary tube is rigid and relatively easy to secure to the inner wall of a rearing tank with its tip below the water surface. We have found 500 mL Styrofoam containers to be especially suitable for rearing because the needle can be driven through the lip of the container (or lid) to project beneath the water surface (Fig. 2). The containers may be set up in pairs along either side of the main aeration lines.

Our containers (opening, 10.8 cm; depth, 6.8 cm) and lids were purchased from a restaurant supply company for a nominal fee ($50/500 containers and lids). The containers are sturdy enough to hold several cm of sediment and are filled with dechlorinated tap water. Marking pens can be used to label treatment numbers on the side of the container. We also use a dash-dot treatment code on the upper lip. In addition, color-coded dress pins may be inserted on the upper lip to aid in distinguishing containers.

We modify the lids of the containers to retain emerging specimens. The central portion of each lid is cut out leaving a 1-cm rim to which we attach nylon hardware cloth. When larger emergence cages are required, we use 2-L plastic tubs (depth, ca. 15 cm) that stand over the entire unit. Large areas of plastic are removed and replaced with nylon hardware cloth attached to the frame.

We have successfully used this inexpensive set-up in numerous applications. Although we typically use a laboratory air line, a powerful electric aquarium pump provides sufficient pressure to power the system. Also, the aeration system can be housed in an environmental room or growth chamber whenever temperature control is necessary. In our most recent work on the effects of larval density and food limitation on growth of a mayfly (Ephemeroptera) species, we used the aeration system to maintain 250 containers. This set-up required 20 m of regular tubing, 50 m of capillary tubing and 15 T-connectors. Such dependable aeration systems can contribute to the successful rearing of aquatic invertebrates.

ACKNOWLEDGMENTS

We thank Robert L. Baker, Jan J.H. Ciborowski, John E. Havel and Zsolt E. Kovats for their comments on the paper. Funding was provided by a grant from the Natural Sciences and Engineering Research Council of Canada to LDC. Reference to trade names does not imply endorsement of commercial products.